

## STRONGYLE NEMATODES FROM QUEENSLAND MARSUPIALS

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The present paper is the fourth of a series dealing with the nematode parasites of Australian marsupials (1938, a, b, c). Most of the material has been collected from the stomach, from which situation all the specimens were found to belong to genera of Strongylidae, Trichoneminae. The few specimens taken from the intestine belong to *Globocephaloides*, and the finding of males, previously unknown, has permitted the addition of male characteristics to the generic diagnosis and the assignment of the genus to the Strongylinae. Three new genera, *Papillostrongylus*, *Coronostrongylus* and *Buccostrongylus*, have been proposed. Cobb's *Zoniolaimus*, based on some minute figures and formulae but without any other description, has been rehabilitated, *Labiostongylus* being regarded as a synonym of it. The collection studied has been brought together by the senior author over a period of thirty years.

Acknowledgment is made of the assistance rendered by Dr. F. H. S. Roberts, Parasitologist, Stock Department, Brisbane; and especially by the late Dr. T. L. Bancroft, of Eidsvold, and by his daughter, Dr. M. J. Maekerras. The investigation has been made possible by the Commonwealth Research Grant to the University of Adelaide.

The types of all new species have been deposited in the South Australian Museum, Adelaide.

### LIST OF NEMATODES REFERRED TO IN THIS PAPER, ARRANGED UNDER THEIR HOSTS

- Macropus major* Shaw. *Pharyngostrongylus macropodis* Y. and M.; *Zoniolaimus bipapillosus* n. sp.
- Macropus dorsalis* Gray. *Pharyngostrongylus gamma* n. sp.; *P. delta* n. sp.; *P. epsilon* n. sp.; *P. zeta* n. sp.; *Zoniolaimus uncinatus* n. sp.; *Cloacina bancroftorum* n. sp.; *C. burnettiana* n. sp.; *C. longispiculata* n. sp.; *Cloacina* sp.; *Buccostrongylus buccalis* n. sp.; *Papillostrongylus labiatus* n. sp.; *Globocephaloides wallabiae* n. sp.; *G. affinis* n. sp.
- Macropus parryi* Bennett. *Pharyngostrongylus macropodis* Y. & M.; *P. gamma* n. sp.; *P. brevis* Canavan; *Macropostrongylus yorkei* Baylis; *Zoniolaimus bancrofti* n. sp.; *Cloacina communis* J. & M.; *Buccostrongylus buccalis* n. sp.
- Macropus agilis* Gould. *Cloacina robertsi* n. sp.; *C. longispiculata* n. sp.; *C. macropodis* J. & M.; *Macropostrongylus macropostrongylus* Y. & M.; *Cloacina* sp.
- Macropus zelsbyi* Longman. *Zoniolaimus insularis* n. sp.; *Macropostrongylus macropostrongylus* Y. & M.; *M. yorkei* Baylis; *Cloacina macropodis* J. & M.; *Cloacina* sp.
- Macropus thetidis* Lesson. *Pharyngostrongylus zeta* n. sp.; *Buccostrongylus australis* n. sp.; *Coronostrongylus coronatus* n. sp.

*Macropus wilcoxi* McCoy. *Zoniolaimus communis* n. sp.; *Buccostrongylus buccalis* n. sp.; *B. australis* n. sp.; *Coronostrongylus coronatus* n. sp.; *Cloacina macropodis* J. & M.

*Macropus ualabatus* Lesson & Garnot. *Zoniolaimus communis* n. sp.

*Macropus apicalis* Gunther. *Zoniolaimus uncinatus* n. sp.; *Cloacina similis* n. sp.; *Cloacina* sp.

*Macropus* sp. (from Millmerran, Darling Downs). *Zoniolaimus communis* n. sp.; *Pharyngostrongylus eta* n. sp.

*Petrogale penicillata* Gray. *Pharyngostrongylus zeta* n. sp.; *P. alpha* J. & M.; *Cloacina similis* n. sp.; *C. robertsi* n. sp.

*Onychogale frenata* Gould. *Zoniolaimus onychogale* n. sp.

*Isoodon obesulus* Shaw. *Cloacina* sp.

*Macropus* sp. from Millmerran is a wallaby. It is probably either *M. ruficollis* or *M. dorsalis*, the former species being stated by Le Souef and Burrell ("The Wild Animals of Australia," 1926) to occur "in drier forest country" and the latter "in rough open country." *M. ruficollis* seems to be the more likely species. Wood Jones (Mammals of South Australia, pt. ii, 1924, p. 245) states that the name *M. ruficollis* Desmarest should be restricted to the form from King Island, Bass Strait, and that *M. rufogriseus* Desm. is the correct name for the mainland species. This same author (*l.c.* p. 247) points out that *Macropus (Wallabia) bicolor* Desm. has priority over *M. ualabatus (typicus)* Less. & Garn.

We take the opportunity to make some corrections in regard to host names contained in our earlier papers. When dealing with *Dipetalonema roemeri*, we mentioned (1938 a) *Macropus ualabatus* (Hawkesbury River) amongst the hosts on page 107 but omitted it from the list on page 111; *M. ruficollis* was given on page 111 but omitted from page 107, the locality being the Blue Mountains, New South Wales. We have been informed by Dr. Roberts that *Macropus* sp. from Inverleigh, Carpentaria, the animal from which *Dipetalonema annulipapillatum* was recorded by us (1938 c, 189) is *M. agilis*. In the same paper we described *Austroxyuris finlaysoni*, *Passalurus parvus* and *Oxyuris acuticaudata* from the flying opossum, *Petauroides volans*, the variety being indicated on the original label as *minor*. Mr. Finlayson, in his account of the mammals of the Dawson and Fitzroy River valleys (Trans. Roy. Soc. S. Aust., 58, 1934, 219), has identified the host specimen as var. *incanus* Thomas.

#### ZONIOLAIMUS Cobb, 1898

The author did not give a diagnosis of the genus nor any verbal account of the two species which he named. The only information is contained in a very small figure of one of them (*Z. scitifera*) and of the genital system of the other (*Z. brevicaudatus*), together with the "formula" of one sex for each. The host of the former was given as the brush wallaby from Moss Vale, New South Wales. This animal was *Macropus ualabatus*. The host of the other parasite was not indicated, but the material was probably also obtained from the same species of

marsupial. Railliet thought that the genus might be synonymous with *Cloacina*. Yorke and Maplestone (1926), as well as Baylis and Daubney (1926), gave brief diagnoses based on Cobb's figures.

We have examined a number of species which are congeneric with *Zoniolaimus* and now place *Labiostrongylus* Yorke and Maplestone as a synonym of it. The structure of the lips and of the bursa is similar in both. The setae, which are such a striking feature of *Z. setifera*, are present on all the described species of *Labiostrongylus*, though not so highly developed. The lengths stated by Cobb for one of his species (*brevicaudatus*) are incompatible with the figures.

The following diagnosis of the genus is based largely on that given for *Labiostrongylus* by Yorke and Maplestone (1926).

*Trichoneminae*—Mouth directed straight forwards; surrounded by six to eight processes; submedian largest and may or may not be bilobed; laterals simple; ventral and dorsal, if present, quite small and conical. Buccal capsule large, cylindrical, heavily chitinised. Oesophagus long, slender, surrounded at its base by one or more pairs of lateral pouches from intestine.

*Male*—Bursa large; lobes clearly defined; ventral lobes usually separate. Ventral rays together, parallel; externo-laterals and externo-dorsals shorter than laterals (with which they arise) and usually lifting lateral wall of the bursa. Laterals long, parallel. Dorsal ray usually stout, ending in two branches lying in lappets of dorsal lobe; one pair of lateral rays given off either from main stem or a ray from each of the two branches. Genital cone usually prominent; accessory cone present. Spicules thin, with striated alae and simple points. Gubernaculum present or absent.

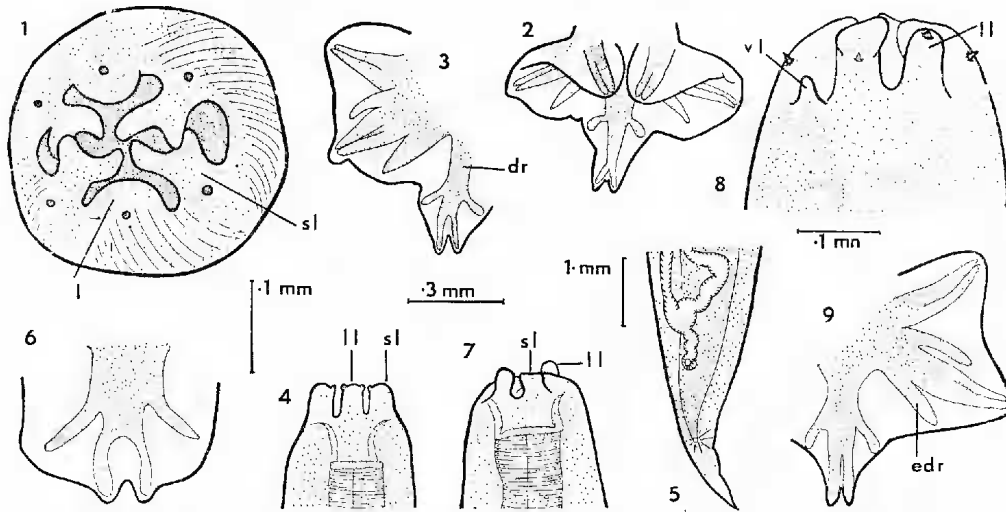
*Female*—Body posterior to vulva narrowing to a pointed tail. Uteri parallel; vagina varying in length, usually twisted; vulva not far in front of anus; the distance between vulva and anus not greater than that from anus to tip of tail. Eggs relatively small. From stomach of marsupials. Type, *Z. setifera* Cobb, 1898, from a "brush wallaby" (*Macropus ualabatus*). Other species: *Z. brevicaudatus* Cobb, 1898, host not stated but probably *M. ualabatus*; also the following species originally described under *Labiostrongylus*: *Z. labiostrongylus* (Y. and M., 1926), *Z. longispicularis* (Wood, 1929), *Z. macropodis* (Johnston and Mawson, 1938), *Z. grandis* (Johnston and Mawson, 1938), *Z. petrogale* (Johnston and Mawson, 1938). Six new species are proposed in the present paper: *Z. bancrofti* from *Macropus parryi*; *Z. bipapillosus* from *M. major*; *Z. communis* from *M. ualabatus*, *M. wilcoxi* and *M. sp.* from Millmerran; *Z. insularis* from *M. welsbyi*; *Z. uncinatus* from *M. dorsalis* and *M. apicalis*; and *Z. onychogale* from *Onychogale frenata*.

***Zoniolaimus bancrofti* n. sp.**

Figs. 1-2

From *Macropus parryi*, near Eidsvold, Upper Burnett River, collected by the late Dr. T. L. Bancroft.

Stout worms. Males, about 30-33 mm. long and 1 mm. wide; females, 31-45 mm. long by 1.5 mm. broad. Head surmounted by six lips; four submedian lobed, each bearing proximally a small rounded papilla with bristle; the two laterals simple, distal part of each rather larger and bearing small papilla. Anterior end of oesophagus 0.2 mm. from top of lips; chitinised wall of buccal capsule 0.12 mm. deep. Oesophagus 7.35 mm. long (1:4.4 of body length) in male; 10 mm. (1:4.4 of body length) in female; widening gradually towards base; posterior end surrounded by a pair of lateral lobes from intestine.



Figs. 1-2, *Zoniolaimus bancrofti*: 1, Anterior view of head; 2, Ventral view of bursa. Figs. 3-5, *Zoniolaimus bipapillosus*: 3, Right part of bursa; 4, Lateral view of head; 5, Posterior end of female. Figs 6-7, *Zoniolaimus communis*: 6, Dorsal ray of bursa; 7, Head. Figs 8-9, *Zoniolaimus insularis*: 8, Head; 9, Left part of bursa. Figs. 1 and 5 to same scale; 2, 3, 4, 7 and 9 to same scale.

#### REFERENCES TO LETTERING

a, anus; ac, accessory genital cone; br, buccal ring; cp, cervical papilla; dp, dorsal papilla; dr, dorsal ray; edr, externo-dorsal ray; ep, excretory pore; gc, genital cone; ll, lateral lip; lp, lateral papilla; nr, nerve ring; p, prebursal papilla; s, spicule; sl, submedian lip; sp, submedian papilla; t, tooth; v, vestibule; vl, ventral lip; vr, ventral ray; vu, vulva.

*Male*—Spicules rather short, 3.66 mm. long, 1:9 of body length; with narrow alae; small irregular gubernaculum. Bursa large, with long prominent dorsal lobe; laterals wide; ventrals not joined to one another. Ventral rays cleft for half length and reaching almost to edge of ventral lobe; externo-lateral extending to edge of junction between ventral and lateral lobes; laterals long, parallel, cleft for nearly all length; externo-dorsal shorter, arising from same base as laterals. Dorsal ray stout; giving off near mid-length two short club-shaped lateral branches reaching edge of bursa near beginning of dorsal lobe; main dorsal ray passing on, narrowing until near its base, then dividing into two short branches, each of these extending into one of the two terminal lappets of the dorsal lobe.

*Female*—Body posteriorly to anus narrowing greatly to end in thin pointed tail. Vagina very short, narrow, coiled; distance from junction of ovejectors to vulva 0·8 mm.; vulva 1·15 mm. from anus; anus 1·12 mm. from tip of tail.

The species resembles *Z. labiostrongylus* in general proportions, but differs in the form of the externo-lateral and externo-dorsal rays, the character of the dorsal ray, and in the absence of dorsal and ventral lips.

***Zoniolaimus bipapillosus* n. sp.**

Figs. 3-5

From stomach of *Macropus major*, Upper Dawson Valley (coll. Dr. Bancroft). Long, stout worms. Males, 28·37 mm. long; females, about 50 mm. Six lips; two laterals each with pair of small rounded papillae; submedians simple, each with ridge on inner edge facing mouth cavity. Buccal capsule 0·12 mm. deep by 0·1 mm. wide; with strongly chitinised walls and floor. Oesophagus 12-12·5 mm. long, 1:3-4 of body length; beginning 0·28 mm. from top of lips. Nerve cord and excretory pore not recognised in the poorly cleared specimens available.

*Male*—Spicules about 4·3 mm. long, 1:7·4-9 of body length; thin, straight; with striated alae. Bursa large, dorsal lobe long. Ventral rays cleft for most of length, parallel, extending nearly to edge of bursa. Externo-lateral and externo-dorsal rays of equal length and distinctly shorter than laterals with which they arise; laterals cleft for most of length, and passing out almost to edge of bursa which is wider just at this part. Dorsal ray stout, giving off near half its length two lateral branches, extending outwardly nearly to edge of bursa; main dorsal ray passing into longest part of dorsal lobe, and soon dividing into two branches, each terminating in a lappet of the lobe.

*Female*—Body narrowing near region of vulva to end in pointed, tapering tail. Uteri parallel; ovejectors short; vagina very short, twisted; vulva 2·5 mm. from posterior end and 1·2 mm. in front of anus.

The specific name is given on account of the presence of two papillae on each lateral lip. This species shows resemblance to *Z. bancrofti* in regard to the length of spicules, but differs in the form of the dorsal ray, arrangement of the lips, and length of the vagina.

***Zoniolaimus communis* n. sp.**

Figs. 6-7

From stomach of *Macropus ualabatus* (type host) and *M. wilcoxi*, Upper Burnett River (coll. Dr. Bancroft).

Shorter than most Labiostrongyles; male 15·5 mm.; female 16-34 mm. They all tend to be more or less coiled, especially in the tail region. Head with six lips; two laterals shortest, rounded, each with small rounded papilla on upper end; four submedians large, simple, each with thin conical papilla near its base. Buccal capsule about 0·13 mm. in diameter in female; with chitinous walls about

0.1 mm. deep, base 0.16 mm. from anterior end. Oesophagus narrow, relatively long, 7 mm. long in female, one-third of body length; 4.5-5.5 mm. in male, one-fifth body length; around posterior end a dark mass, probably paired intestinal lobes. Nerve ring about 0.6 mm., and excretory pore 0.75 mm. from anterior end in male. Cuticle finely striated transversely.

*Male*—Spicules 4.75 mm. long, 1:3.2 of body length; thin; with very narrow alae and pointed tips. Bursa hard to observe satisfactorily, as it is short and not easily spread out. Ventral lobes separate; dorsal lobe not so much prolonged as in other species. Ventral rays parallel, cleft for most of length, bent so as to penetrate into ventral corners of ventral lobes. Externo-lateral ray very thin, short; externo-dorsal short; laterals long, extending to edge of bursa. Dorsal ray very wide, short; after half its length giving off a long lateral on each side, the main stem soon afterwards dividing into two branches, each projecting into pocket at edge of bursa. Genital cone short.

*Female*—Body narrowing towards posterior end, more suddenly after anus, to terminate in short pointed dorsally-directed tail. Uteri parallel; ovejectors short, stout; vagina fairly long, twisted, full of very small eggs. Anus 1.1 mm. from tip of tail; vulva 0.65 mm. in front of anus. Eggs 0.11 by 0.08 mm.

This species differs from other six-lipped forms in the characters of the dorsal ray and in the relatively short length of the worm. The nearest ally seems to be *Z. longispicularis*, from which it differs in regard to the dorsal ray, body length, shortness of vagina and the presence of posterior submedian papillae on the lips.

#### *Zoniolaimus insularis* n. sp.

Figs. 8-9

From stomach, *Macropus welsbyi*, Stradbroke Island.

Male 43-44 mm. long, breadth 1.5 mm.; female about 50 mm. long, 3 mm. broad. Eight lips; submedians lobed, each with small conical papilla, laterals simple with small rounded papilla; dorsal and ventral lips very short. Buccal capsule 0.1 mm. long by 0.14 mm. broad, base 0.25 mm. distant from anterior end of lips. Oesophagus 10-11 mm. long in male, 1:3.4-4.4 of body length; 15 mm. in female, 1:3.4 of body length; narrow. Intestinal lobes which more or less surround the base of the oesophagus in species of *Zoniolaimus* are practically absent in this form. Nerve cord not more than 1.7 mm.; excretory pore at about 1.7 mm.; and cervical papillae at 1.15 mm. from anterior end.

*Male*—Bursa large; ventral lobes separate, dorsal lobe prolonged. Externo-lateral and externo-dorsal rays arising with laterals; externo-dorsal extending almost to edge of lateral lobe; laterals long, dividing at half length and extending nearly to bursal edge. Dorsal ray giving off at about half length a short branch from each side, main stem passing on to subdivide into two subequal, fairly long rays projecting each into a distinct lappet of the bursa. Spicules 4.5-5.5 mm.; 1:8.8-9.4 of body length; with striated alae almost to tips; tips pointed and separate.

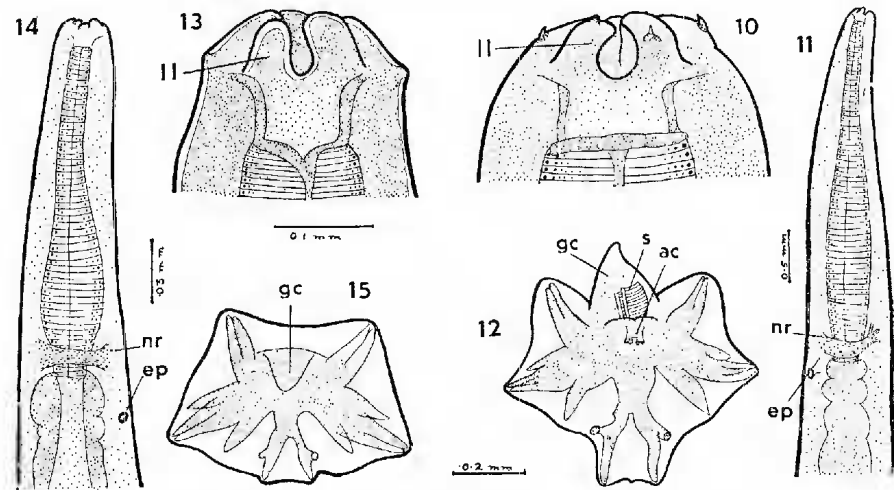
*Female*—Uteri large, parallel; parts of ovejectors distinct, muscular; vagina short, twisted; vulva 1·7 mm. in front of anus, and 3·6 mm. from posterior end; anus about midway between vulva and tip of tail.

This species is close to *Z. labiostrongylus*, but shows slight differences in the length of spicules and oesophagus, branching of dorsal ray, longer externo-lateral and externo-dorsal rays, position of papilla on each submedian lip (as indicated in Yorke and Maplestone's figure), and in the presence of a papilla on each lateral lip (not mentioned by these authors).

***Zoniolaimus uncinatus* n. sp.**

Figs. 10-12

From *Macropus dorsalis* (type host), Upper Burnett River (coll. Dr. Bancroft), and Botanical Gardens, Brisbane; also from *Macropus apicalis* (female worms only) from the Upper Mary River, near Woolooga.



Figs. 10-12. *Zoniolaimus uncinatus*: 10, Head; 11, Anterior end; 12, Posterior view of bursa. Figs. 13-15, *Zoniolaimus onychogale*: 13, Head; 14, Anterior end; 15, Posterior view of bursa. Figs. 10 and 13 to same scale; figs. 12 and 15.

Worms short for this genus: male 19-22 mm.; female 27-35 mm. Head rounded; six lips, each submedian with a prominence at half length provided with a hook-like papilla (hence specific name); laterals each with small rounded papilla near apex; submedians large but not bilobed distally. Buccal capsule quite shallow, 0·05 mm. deep, 0·1 mm. wide; base 0·13 mm. from top of lips. Oesophagus about 3 mm. long (1:7-8 of body length); of distinctive shape, last two-thirds about twice as wide as first third; thicker part quite distinct to naked eye, being much darker than the rest of the alimentary canal. Around posterior end of oesophagus is a band of tissue, probably the nerve ring. Just behind the latter is the excretory pore. Cervical papillae stiff, bristle-like; at 1·5 mm. from anterior end in male.

*Male*—Bursa large; ventral lobes separate; dorsal lobe long, squarish, with free end forming three lappets. Ventral rays cleft for about half length; externo-lateral short, thin; laterals cleft for half length; externo-dorsal arising with laterals, stout, long. Dorsal ray stout; dividing before half its length into two branches, each soon giving off a short lateral ray before proceeding to the edge of bursa; one branch occupying each lateral lappet of the dorsal lobe; the lateral ray directed dorsally. Spicules straight; stout; 2.4-2.6 mm. long, 1:8-9 of body length; with very wide striated alae ending near tips which are joined. Genital cone well developed; accessory cone ending in two short, relatively wide processes, each indented at tip.

*Female*—Uteri parallel; ovejectors muscular, spindle-shaped; vagina straight, narrow, with small eggs, 0.06 mm. by 0.12 mm. Vulva about 2.4 mm., and anus 1.35 mm. from posterior end. Tail long, tapering.

This species differs from other Labiostrongyles in the form of the dorsal ray, shape of the oesophagus, and position of the nerve ring, excretory pore and cervical papillae.

***Zoniolaimus onychogale* n. sp.**

Figs. 13-15

From stomach of *Onychogale frenata*, Upper Burnett River (coll. Dr. Bancroft).

Short stout worms closely resembling *Z. uncinatus*, both externally and internally, but differing chiefly in the length of spicules, though there are also slight differences in the shape of the female tail, the dorsal lobe of the bursa, the depth of the buccal capsule, and the form and position of the lip papillae. Males about 11 mm.; females 24-26 mm. Six lips; submedians with prominence near base, representing broad low papilla; laterals with small median papilla near anterior edge. Buccal capsule strongly chitinised, 0.06 mm. deep by 0.08 mm. wide. Oesophagus about 1.45 mm. long, posterior half wider. Nerve ring surrounding base of oesophagus; excretory pore posterior to end of oesophagus; this region of body very closely resembling that of *Z. uncinatus*.

*Male*—Bursa large; dorsal lobe not so long as in *Z. uncinatus*. Ventral rays long, parallel; externo-laterals short; laterals long, cleft for most of length; externo-dorsal arising with laterals, but shorter; dorsal ray bifurcated at about end of first third, each branch giving off short lateral at about half way. Spicules long, 4.2 mm., 1:2.6 of body length; very thin. Gubernaculum present; genital cone large; accessory cone not seen because of condition of specimen.

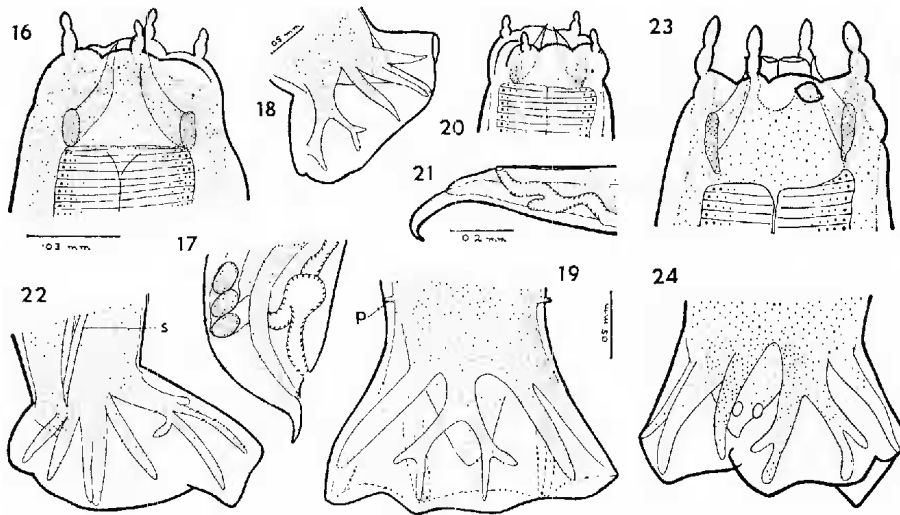
*Female*—Body stout, narrowing suddenly after vulva; rather long tapering tail curved dorsally. Anus 1.4 mm. from the tip; vulva 0.7 mm. in front of anus. Uteri parallel; ovejectors long; vagina narrow, short. Eggs in vagina 0.16 mm. by 0.09 mm.



## Genus CLOACINA Linstow, 1898

This genus does not appear to be nearly so well represented in Queensland marsupials as in those of Central Australia. We have recently (1938 b) given a diagnosis. Five new species are now described: *Cloacina bancroftorum* and *C. burnettiana* from *Macropus dorsalis*; *C. similis* from *M. apicalis* and *Petrogale penicillata*; *C. robertsi* from *M. agilis* and *Petrogale penicillata*; *C. longispiculata* from *M. dorsalis* and *M. agilis*.

Two recently described species, *C. communis* and *C. macropodis* J. & M., were recognised amongst Queensland material.



Figs. 16-19, *Cloacina robertsi*: 16, Head (male); 17, Posterior end of female; 18, Dorsolateral view of bursa; 19, Dorsal view of bursa. Figs. 20-22, *Cloacina burnettiana*: 20, Head of female; 21, Posterior end of female; 22, Dorsolateral view of bursa. Figs. 23-24, *Cloacina similis*: 23, Head of female; 24, Dorsolateral view of bursa. Figs. 16, 20 and 23 to same scale; figs. 21 and 22; figs. 19, 22, and 24.

***Cloacina robertsi* n. sp**

Figs. 16-19

From the rock wallaby, *Petrogale penicillata* (type host), Upper Burnett River (coll. Dr. Bancroft); and *Macropus agilis*, Gregory River, North Queensland (coll. Dr. Roberts).

Fairly robust worms; male 5.5-11 mm.; female 6.0-9.8 mm. Six lips, each submedian with a two-jointed papilla whose upper segment is the smaller. Cuticle constricted slightly at base of lips. Buccal capsule very shallow, about 0.01 mm. deep and 0.034 mm. in diameter, well set back from anterior end of worm, so that its base is 0.03 mm. from oral opening. Leaf crown of six elements arising from base of capsule, tips pointed and surrounding small mouth aperture 0.008 mm. in diameter. Oesophagus short; 0.42-0.5 mm. in male (1:13-20 of

body length); 0.4-0.48 mm. in female (1:20.4-21.5 of body length); widened at base but without definite bulb. Nerve ring at 0.2-0.3 mm. from anterior end, surrounding oesophagus just behind mid-length; excretory pore near posterior end of oesophagus. Cervical papillae at 0.08-0.11 mm. from anterior end; long; threadlike.

*Male*—A pair of prebursal papillae. Bursa large; lobes not deeply separated; ventral lobes continuous. Ventral rays thin, parallel, reaching edge of bursa. Externo-lateral and externo-dorsal arising from same root as, and a little shorter than, laterals; latter thin, parallel, cleft for most of length, and almost reaching bursal edge. Dorsal ray bifurcating at about one-third length, each branch passing outwards and downwards and giving off at about mid-length a shorter lateral ray, no terminations reaching bursal edge. Genital cone large. Spicules very long, 2.3-5.65 mm., 1:2-2.4 of body length, thin, with striated alae and long pointed tips.

*Female*—Body narrowing suddenly just posteriorly from vulva; short backwardly-directed pointed tail. Uteri parallel; vagina very short; vulva 0.16-0.3 mm., and anus 0.07-0.15 mm. from posterior end; eggs large, 0.11 by 0.06 mm.

This species resembles *C. macropodis* in general anatomy and length of spicules, but differs in the shape and size of the papillae, buccal capsule and lips. It also resembles *C. curta* J. & M., but differs from it in regard to the oesophagus, dorsal ray and length of vagina.

#### *Cloacina burnettiana* n. sp.

Figs. 20-22

From stomach of *Macropus dorsalis*, Upper Burnett River (coll. Dr. Bancroft). Thin; very short; male 2.35-3 mm.; female 3.1 mm.; body narrowing towards head; extreme anterior end rather enlarged to give rise to eight wide shallow lips, the four submedians each with a two-jointed papilla, 0.01 mm. high. Buccal capsule 0.017 mm. in diameter, with thick walls 9  $\mu$  high; leaf crown of six elements arising from base of capsule and bent inwards, nearly closing mouth opening. Oesophagus short; 0.39-0.42 mm. long (1:6-7 of body length) in male; 0.3 mm. (1:10 of body length) in female; wide, generally enlarging towards base, latter not markedly bulbous; anterior end 0.015 mm. from top of lips. Intestine pigmented. Nerve ring 0.2-0.29 mm. in male, 0.15 mm. in female from anterior end and at about mid-length of oesophagus; excretory pore just behind nerve ring.

*Male*—Spicules straight, narrow, 0.69-0.88 mm. long, 1:3.4 of body length, with wide striated alae ending a short distance from tips. Bursa large; lobes distinct, ventrals almost separated from each other. Ventral rays long, parallel, cleft for nearly whole length. Externo-lateral diverging from lateral almost at its base and, like laterals, reaching almost to edge of bursa; externo-dorsal arising with laterals, but diverging widely, long, thin, not reaching edge. Dorsal ray dividing at about half length into two long thin branches nearly reaching edge of

bursa; each branch close to its origin giving off a lateral of about one-quarter its own length. Genital cone insignificant.

*Female*—Body narrowing beyond vulva to end in long pointed backwardly-directed tail. Uteri parallel; ovejectors stout; vagina quite short; vulva 0.38 mm., and anus 0.21 mm. from tip of tail. Large eggs in upper part of uterus but none seen in vagina or ovejectors of the only female available for study.

The species differs from all known representatives of the genus in regard to size and the characters of the dorsal ray.

### *Cloacina similis* n. sp.

Figs. 23-24

From the stomach of *Petrogale penicillata*, Upper Burnett River (coll. Dr. Bancroft). This species closely resembles *C. communis*, *C. magna*, and *C. petrogale* (hence specific name, *similis*) in the structure of the anterior end, but the female differs from that of the first two in the shape of the body, while the male has spicules with a relative length (spicule length:body length) nearer to that in *C. communis* than in the other two. The vagina is shorter than in any of these species, though the form of the tail and the relative positions of anus and vulva are similar in all. Male 8.1-8.2 mm.; female 7.1 mm. long. Oesophagus 0.84-0.9 mm.; 1:8-9.5 of body length. Nerve cord at 0.3 mm., excretory pore 0.8-0.83 mm., and cervical papillae at 0.07-0.08 mm. from anterior end.

*Male*—Bursa with well marked lobes, ventrals separate, dorsal bilobed. Ventral rays parallel, reaching edge of bursa; externo-laterals short; laterals cleft for most of length, not reaching edge of bursa; externo-dorsals arising with laterals and of similar length but divergent. Dorsal ray bifurcating after about one-third length, each branch bifurcating after half its length, the two final branches not reaching edge of bursa. Pair of prebursal papillae about 0.5 mm. from upper edge of bursa. Spicules long, 1.85-2.15 mm. (1:4.4-3.7 of body length), with striated alae and simple points.

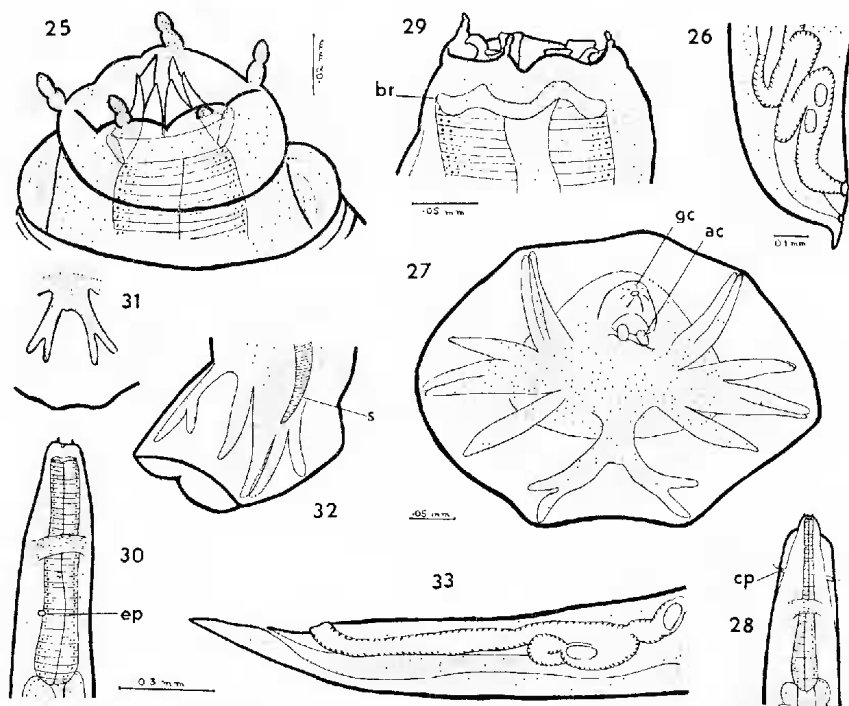
*Female*—Posterior end narrowing suddenly to end in conical tail, 0.14 mm. long; vulva 0.17 mm. in front of anus; latter 0.14 mm. from tip of tail; vagina about 0.5 mm. long; eggs 0.14 by 0.08 mm.

### *Cloacina longispiculata* n. sp.

Figs. 25-28

From *Macropus agilis*, Gregory River district, Carpentaria (coll. Dr. Roberts). Very stout worms, tapering rapidly at anterior end, but extremely little posteriorly; male 5.6-6 mm. long with maximum diameter 0.08 mm.; female 10-12 mm. long, 0.1 mm. broad. Cuticle inflated at anterior end, forming a cervical collar beginning 0.05 mm. from head end, where it projects 0.03 mm. from the body proper, and extending backwards for about 0.2 mm., gradually narrowing. Cervical papillae stout, passing through the inflated part of cuticle, 0.18 mm. from head end, and projecting as narrow filaments about 0.025 mm.

long. In many specimens the anterior end is damaged but a few show six low lips, with two-jointed papillae on the submedian and a small papilla on each lateral lip. Leaf crown prominent, arising from a narrow buccal ring, 0.03 mm. diameter and about 0.01 mm. in depth. Nerve ring at beginning of second half of oesophagus; the latter 0.52 mm. long, widening behind nerve ring. Excretory pore not observed.



Figs. 25-28, *Cloacina longispiculata*: 25, Head; 26, Posterior end of female; 27, Posterior view of bursa; 28, Anterior end. Figs. 29-33, *Cloacina bancroftorum*: 29, Head; 30, Anterior end; 31, Dorsal ray; 32, Lateral view of bursa; 33, Posterior end of female. Figs. 28, 30 and 33, to same scale; figs. 29, 31 and 32.

*Male*—Spicules exceedingly long; 3.5-3.7 mm. long, hence more than half body length; with wide alae. Bursa large; genital cone short; accessory cone of two small lobes. Ventral rays cleft to base; externo-lateral slightly shorter than medio- and postero-laterals which are cleft half-way and reach almost to edge of bursa; externo-dorsal arising with these latter and a little shorter; dorsal bifurcating about mid-length, each branch almost reaching bursal edge and giving off a short stout lateral ray near its end.

*Female*—Body tapering very suddenly beyond vulva to end in short pointed tail. Vagina long, wide, coiled. Vulva 0.37 and anus 0.17 mm. from tip of tail. Eggs (in vagina) 0.14 by .08 mm.

This species is characterised by the presence of the cervical collar and the very long spicules.

***Cloacina bancroftorum* n. sp.**

Figs. 29-33

From stomach of *Macropus dorsalis*, Upper Burnett River (coll. Dr. Bancroft and Dr. J. M. Mackerras).

Short stout worms tapering markedly at head end. Males 4.5 mm.; females 4.2-5.8 mm. Six low lips; on top of each submedian a very small two-jointed papilla. Lips forming very wide circle around anterior end; within circle is leaf crown with each element wide and turned outwards at its distal end; mouth aperture correspondingly large. Buccal capsule shallow, chitinous walls uneven, with pronounced wavy outline. Oesophagus wide, straight, slightly wider at base, length in male 0.75 mm. (one-sixth body length), length in female 0.7-0.73 mm. (1:6-8 of body length); intestine very wide. Nerve ring 0.35 mm. from anterior end, lying at about mid-length of oesophagus. Excretory pore at 0.55-0.6 mm.; cervical papilla 0.09 mm. from head end.

*Male*—Spicules straight, short, 0.65 mm. (1:7 of body length), with wide striated alae. Genital cone short. Bursa lobes distinct, ventrals joined. Ventral rays long, parallel, cleft for almost whole length, extending nearly to edge of bursa; externo-laterals and laterals long, almost reaching edge; externo-dorsal not so long; dorsal ray soon dividing, each branch subdividing into two subequal branches, none reaching the edge of bursa.

*Female*—Body tapering gradually to end in a pointed tail. Uteri parallel; vagina long, rather narrow; vulva 0.48 mm., anus 0.25 mm. from tip of tail; eggs 0.11 by 0.04 mm.

The chief distinctive characters are the width of the buccal cavity, size of the papilla, shape of the chitinous wall of the buccal capsule and the length of the spicules. The specific name is given in recognition of the very valuable service rendered for many years by the late Dr. Bancroft and by his daughter, Dr. J. M. Mackerras.

**CLOACINA COMMUNIS J. & M., 1938**

Female specimens were obtained from *Macropus parryi*, Upper Dawson Valley (River Dec), collector Dr. Bancroft.

**CLOACINA MACROPODIS J. & M., 1938**

This species was represented amongst material taken by Dr. Roberts from *Macropus agilis*, Gregory River, North Queensland; and from *M. welsbyi*, Stradbroke Island.

**CLOACINA sp.**

Specimens of one or more species belonging to *Cloacina* were found amongst material taken from *Macropus apicalis* (Upper Mary River); *M. dorsalis* (Eidsvold); *M. welsbyi* (Stradbroke Island); *M. agilis* (Gregory River); and *Isoodon obesulus* Shaw (Eidsvold). Their state of preservation prevented further identification.

## Genus PHARYNGOSTRONGYLUS Yorke and Maplestone, 1926

Syns. *Spirostrongylus* Mönnig, 1926; *Rugopharynx* Mönnig, 1926

The following diagnosis is based largely on that of Yorke and Maplestone: *Trichoneminae*—Body tapering gradually anteriorly, head directed straight forwards, mouth collar with six rounded papillae of which the two lateral may be larger than the four submedian. Cuticle smooth, with (in some cases) a few fine striations anteriorly. Buccal capsule short, cylindrical. Corona radiata, if present, arising from near the anterior end of the buccal capsule; external leaf crown may be present. Buccal capsule leading into a cylindrical vestibule of varying length, with heavily chitinised walls, which are striated in different directions in the different species, some circularly, some spirally, some radially. Oesophagus long, slender, usually divided into a wider anterior and a shorter narrower posterior region ending in a bulb. Cervical papillae long, thin. Excretory pore behind nerve ring.

*Male*—Bursa short, lobes distinctly separated; ventrals may be joined (type species) or separate. Inside surface of bursa usually with numerous papillae. Ventral ray cleft distally; externo-lateral, lateral and externo-dorsal arising together, laterals being longest; externo-lateral and externo-dorsal often lifting lateral wall of bursa. Dorsal ray divided for at least half its length, each long secondary stem giving off near its anterior end a short lateral branch. Spicules short and stout or long and thin; wide striated alae. Usually a prominent genital cone and an accessory cone. Gubernaculum may be present.

*Female*—Posterior extremity narrowing suddenly behind vulva to end in a long tapering tail. Uteri parallel; vulva a short distance in front of anus.

Parasites in the stomach of marsupials. Type species: *P. macropodis* Y. & M. Other species: *P. australis* (Mönnig, 1926); *P. brevis* Canavan, 1931; *P. woodwardi* Wood, 1930; *P. alpha* Johnston and Mawson, 1938 b; *P. beta* Johnston and Mawson, 1938 b.

Five new species are proposed in the present paper: *P. gamma*, from *Macropus dorsalis* and *M. parryi*; *P. delta*, from *M. dorsalis*; *P. epsilon*, from *M. dorsalis*; *P. zeta*, from *M. dorsalis*, *M. thetidis*, and *Petrogale penicillata*; *P. eta*, from *Macropus* sp. We also record the identification of specimens of *P. macropodis* Y. & M., from *Macropus parryi* and *M. major*; *P. brevis* Canavan, from *Macropus parryi*; and *P. alpha* J. and M. from *Petrogale penicillata*.

**Pharyngostromylus gamma** n. sp.

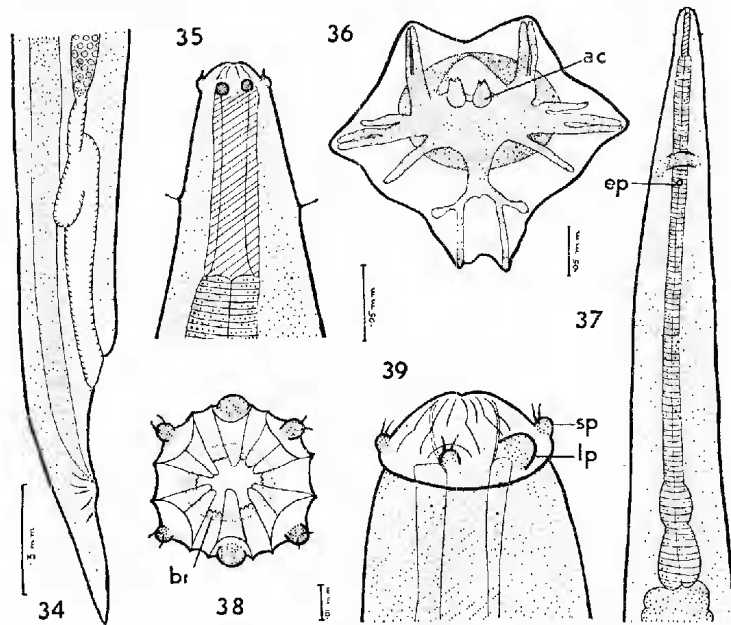
Figs. 34-39

From stomach of *Macropus dorsalis* (type host) and *M. parryi*, both from the Upper Burnett River (coll. Dr. Bancroft).

Thin; male 5.8-6.6 mm. long, shorter and relatively stouter than female 7.6-8.7 mm. long. Mouth collar with six papillae; the four submedians thinner, more prominent, and each with two bristles; laterals stout and squat. Rounded anterior end arising from within the collar and protected by an external leaf crown of

ten elements; the latter arranged so that two come up from the region of each submedian papilla, and one from each lateral papilla, the interpapillary areas being apparently unprotected. Around the base of each papilla is a non-chitinised area. Upper ends of elements curved inwardly. On looking down into the circular mouth, the anterior edge of the buccal capsule appears to consist of numerous minute pieces closely fitted together in a circle, the inner edges giving a serrated effect. This is probably the internal leaf crown.

Buccal capsule deep (0.013 mm.), with thin curved walls, probable internal leaf crown arising from upper edge. Vestibule or pharynx long, 0.11-0.13 mm., marked by prominent spiral striations arranged at 45° to long axis of organ. Cervical papillae long, thread-like, situated about 0.08-0.17 mm. from anterior end



Figs. 34-39, *Pharyngostromylus gamma*: 34, Posterior end of female; 35, Anterior end; 36, Bursa, posterior view; 37, oesophageal region; 38, Head, anterior view; 39, Head, sublateral view. Figs. 34 and 37 to same scale; figs. 38 and 39 to same scale.

and just behind level of mid-length of vestibule. Nerve cord about 0.4 mm., and excretory pore at 0.45-0.47 mm. from head end. Oesophagus thin, very long; 1.45 mm. in female (1:6 of body length); 1.42-1.49 mm. in male (1:3.8-4.6 of body length); posterior fifth widened, with constriction in its mid-region. Intestine wide, with short loop in its most anterior portion.

*Male*—Spicules narrow, 2.1 mm. long, 1:2.7-3 of body length, with striated alae. Bursa with well-marked lobes; dorsal with shallow median indentation; lateral longest. Ventral rays long, thin, extending almost to edge of bursa, cleft for about half their length; externo-lateral short, stout at base; laterals long, cleft for half their length reaching nearly to edge of bursa; externo-dorsal arising

separately, short, thin. Dorsal ray bifurcating about half length, each stem soon giving off a short club-shaped lateral branch before passing down to meet edge of bursa. Genital cone short, rounded; accessory genital processes rather long, with a bifid distal end.

*Female*—Body narrowing greatly just before vulva to end in long thin tail. Uteri parallel; vagina long; vulva 0.7 mm; and anus 0.45 mm. from posterior end, eggs small (0.04-0.05 by 0.06-0.08 mm.).

This species closely resembles *P. macropodis* but differs in regard to length, striations on vestibule, shape of buccal capsule, and shape of dorsal ray.

### **Pharyngostrongylus delta** n. sp.

Figs. 40-43

From stomach of *Macropus dorsalis*, Upper Burnett River (coll. Dr. Bancroft).

These very small worms are recognisable at a glance by the shape of the vestibule, which is about twice as long as broad; the lumen is long and narrow, and the chitinous wall is constricted at the top and bottom as well as at one-third and two-thirds of its length, so that there appear to be three parts to the vestibule. Of these the first has, in optical section, the form of a trapezium with its base at the posterior end, while the second and third sections are barrel-like. Male 4.47-6.5 mm. long; female about 5 mm. Six small papillae around anterior end, but not adjacent to the small circular mouth. No distinct leaf crown, but inner edge of buccal capsule divided into 12-16 semi-detached sections. Buccal capsule about 5  $\mu$  deep. Vestibule 0.03-0.04 mm. long with circular striations. Oesophagus 0.55-0.64 mm. long in male (1:8-10 of body length), 0.6-0.65 mm. in female (1:8 of body length); wider anterior portion (0.4 mm. in male) followed by narrower part ending in a bulbous enlargement. Nerve cord at 0.4-0.43 mm., and excretory pore at 0.45 mm. from anterior end. Cervical papillae thread-like, 0.07 mm. from head end and just behind vestibule.

*Male*—Spicules quite short, 0.52-1 mm. long (1:6.5-8.6 of body length); rather stout with very wide striated alae and rather thick blunt tips. Internal surface of bursa covered with conical papillae, especially numerous and large on lower edge and on lateral lobes. Lateral lobes long, wide; ventrals short, small, not joined ventrally. Rays difficult to distinguish; externo-lateral lifting lateral wall; externo-dorsal long, stout; dorsal very stout, at about mid-length giving off two short stout lateral processes; and ending in a very short median piece and two long stems reaching almost to bursal edge.

*Female*—Body narrowing at about level of vulva and more suddenly behind anus to end in long thin pointed tail. Ovejectors short; vagina wide, short; vulva 0.27-0.3 mm., and anus 0.22-0.25 mm. from posterior end.

The species is differentiated from all other known members of the genus by the form of the vestibule and dorsal ray, though the shape of the vestibule is somewhat like that of *P. zeta*.

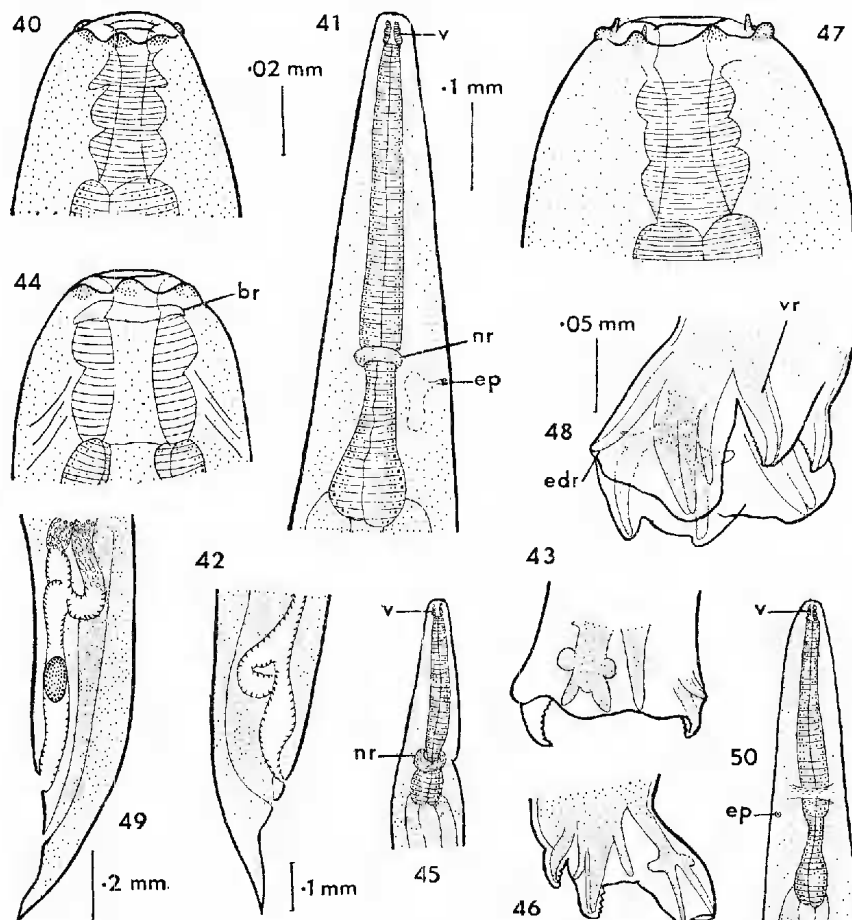


**Pharyngostrongylus epsilon n. sp.**

Figs. 44-46

From stomach of *Macropus dorsalis* (type host) and *M. wilcoxi* Eidsvold (coll. Dr. Bancroft).

Small thin worms resembling *P. delta* but possessing only two subdivisions of the vestibule. Male 4.2-5.3 mm. long, 0.28 mm. broad; female not seen. Six small papillae on mouth collar. Buccal capsule 4  $\mu$  deep, lined by thin cuticle.



Figs. 40-43. *Pharyngostrongylus delta*: 40, Head; 41, Oesophageal region, lateral view; 42, Posterior end of female; 43, Outline of bursa showing dorsal ray. Figs. 44-46 *Pharyngostrongylus epsilon*: 44, Head; 45, Oesophageal region; 46, Bursa, dorso-lateral view. Figs. 47-50. *Pharyngostrongylus zeta*: 47, Head; 48, Lateral view of bursa; 49, Posterior end of female; 50, Oesophageal region. Figs. 40, 44 and 47 to same scale; figs. 43, 46 and 48; figs. 45, 49 and 50.

Vestibule 0.035-0.045 mm. long, 0.01 mm. inside diameter; apparently radially striated; walls about 0.01 mm. thick except in its mid-region, where there is a constriction subdividing the vestibule; inner walls slightly convex in section.

Oesophagus 0.54-0.6 mm. long, 1:7-10 of body length, shorter than in most species of genus, anterior widened portion about five-sevenths of length and narrowing very suddenly to become surrounded by nerve ring; behind the latter is the bulb. Excretory pore at 0.4 mm., and nerve ring at 0.45 mm. from anterior end.

*Male*—Bursa large, papillate; ventral lobes small, separate; lateral lobes larger; dorsal lobe very long with short median indentation. Ventral rays together, parallel; externo-lateral short, but reaching edge of bursa; laterals long, parallel, extending to edge of longest part of lateral lobe, cleft nearly all their length; externo-dorsal arising with laterals and about same length as externo-lateral but not reaching edge of bursa. Dorsal ray stout, bifurcating after half its length, at which point two short lateral branches are given off. Spicules 0.85 mm. long, 1:5-6.2 of body length.

The species resembles *P. delta* but differs in the length of spicules and in the form of the oesophagus and vestibule.

### *Pharyngostromylus zeta* n. sp.

Figs. 47-50

From *Petrogale penicillata*, type host, Upper Burnett River (coll. Dr. Bancroft); *Macropus dorsalis*, Brisbane Botanical Gardens; and *M. thetidis*, Eidsvold (Dr. Bancroft).

Short, thin, tapering towards each end. Male 7.7-8.2 mm. long; female 7.8-8.2 mm. Anterior end with six small papillae, two lateral and four submedian, the latter each with short forwardly-directed process. Vestibule about 0.04 mm. long, 0.013 mm. inside diameter, commencing at 0.019 mm. from head end; with walls 7  $\mu$  average thickness, circularly striated, constricted by two rings so as to appear trilobed in optical section. Oesophagus thin, 0.72-0.75 mm. long in male (1:7.7-10 of body length); 0.8-0.82 mm. in female (1:8.7-10 of body length); anterior tubular portion about three-fifths of total length and surrounded near posterior end by nerve ring, then gradually narrowing to widen into the posterior bulb. Nerve ring at 0.4-0.5 mm., and excretory pore at 0.5-0.6 mm. behind head end. Cervical papillae thread-like, at 0.14-0.15 from anterior end.

*Male*—Spicules rather long, 1.6-1.62 mm., 1:4.2-4.4 of body length, slender, with striated alae, points separate. Bursa large, lobes separated by deep clefts and covered on internal surface by numerous papillae—especially the lateral lobes; ventral lobes small, separate. Ventral rays parallel, reaching edge of bursa; externo-lateral short, parallel to laterals; laterals longer than externo-lateral and cleft for nearly whole length; externo-dorsal arising with laterals and a little longer than externo-lateral and lifting lateral wall of bursa. Dorsal ray stout, soon bifurcating, each branch passing laterally and posteriorly, continuing nearly to edge of deeply indented bursa, each branch giving off after about one-third its length a short lateral ray. Genital cone rather long; accessory cone present.

*Female*—Body tapering from region of vulva to end in long pointed tail. Uteri parallel; ovejectors about 0.3 mm. long; vagina rather long (about

0.75 mm.); vulva 0.37-0.4 mm. in front of anus; anus 0.25 mm. from tip of tail; eggs 0.12 by 0.06 mm.

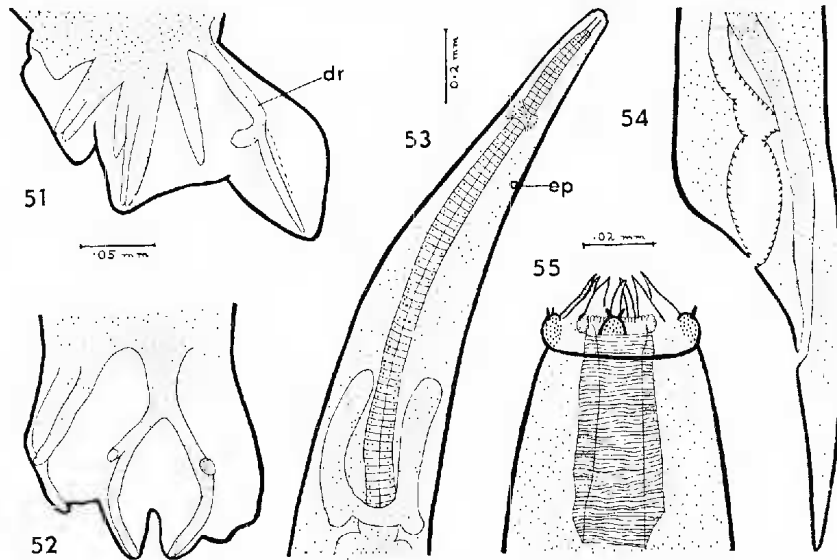
This species has a vestibule with characters intermediate between those of *P. delta* and *P. alpha*, but differs from both in the position of the nerve ring and excretory pore, length of spicules, and shape of vagina.

### *Pharyngostrongylus eta* n. sp.

Figs. 51-55

From stomach of *Macropus* sp. from Millmerran, Darling Downs (Dr. Roberts).

Stout worms; males 8.5-11 mm. long; females 10.7-11.1 mm.; body tapering, especially towards anterior end; usually curved, especially at posterior end. Head very like that of *P. gamma*, differing mainly in having all six papillae of equal



Figs. 51-55, *Pharyngostrongylus eta*: 51, Bursa, lateral view; 52, Bursa, dorsal view; 53, Anterior end; 54, Posterior end of female; 55, Head of female. Figs. 51 and 52 to same scale; figs. 53 and 54.

size, and all bearing two short bristles; internal leaf crown similar; buccal capsule of about the same shape, its anterior edge with numerous small pieces, probably elements of a short internal leaf crown. Buccal capsule 0.026 mm. in internal diameter and 0.01 mm. long. Vestibule 0.06 mm. long, 0.027 mm. internal diameter; walls stout, but narrowing suddenly at their base; walls with annular wavy striations  $8.3 \mu$  apart.

Oesophagus long, thin, narrow, terminating after 1.35 mm. without any bulbar swelling; posterior end surrounded by dorsal and ventral prolongations of granular walls of intestine. Such lobes have been noted in many genera of *Trichoneminae* but are not so long as in the present species. Nerve cord at 0.35 mm., excretory pore at 0.51 mm. from anterior end. Cervical papillae not observed.

*Male*—Spicules 1.3-1.4 mm. long, 1:6-8.5 of body length; genital cone short; inside of bursa (especially lateral lobes) covered with papillae. Ventral rays short, parallel, cleft for half length; externo-lateral parallel to laterals and half their length; laterals extending nearly to edge of bursa, parallel, cleft nearly all their length; externo-dorsal long, arising separately. Dorsal ray longest of all; after one-third length dividing into two branches arranged like calipers, each branch reaching edge of dorsal lobe; latter divided by deep indentation; short lateral ray arising from each branch at about one-third of its length.

*Female*—Body slightly swollen ventrally in front of vulva and narrowing suddenly behind it to end in long tapering tail. Ovejectors long, narrow; vagina short, wide; vulva about 0.31 mm. in front of anus; anus 0.5 mm. from tip of tail; in some specimens tail directed dorsally. Eggs in uterus about 0.04 mm. by .1 mm.

The species possesses features suggesting those of *P. gamma* and *P. macropodis*. From the former it differs in its greater length, relatively shorter spicules, absence of accessory genital cone, relatively shorter vestibule with horizontal striations. It differs from *P. macropodis* in its shorter length, different head papillae and shorter vestibule.

#### PHARYNGOSTRONGYLUS MACROPODIS Y. and M.

We have identified this species from *Macropus major*, Dec River, Upper Dawson Valley (Dr. Bancroft); and from *M. parryi*, Upper Burnett River (Dr. Bancroft).

#### PHARYNGOSTRONGYLUS BREVIS Canavan

Obtained from *Macropus parryi*, Upper Burnett River (Dr. Bancroft).

#### PHARYNGOSTRONGYLUS ALPHA Johnston and Mawson

This species was obtained from a rock wallaby, *Petrogale penicillata*, Upper Burnett River (Dr. Bancroft).

#### **Buccostrongylus** new genus

*Trichoneminae*—Characterised by very long buccal capsule, whose anterior edge may be prolonged into four or six tooth-like projections. No leaf crown; six to eight lips, more or less developed, and behind these are six papillae, four submedian and two lateral, each submedian bearing a thread-like appendage. Buccal capsule twice to three times as long as wide. Oesophagus long, slender, ending in a small but distinct bulb. Intestine pigmented. Bursa small, ventral lobes very small. Externo-dorsal ray arising separately from laterals which are close together. Dorsal ray after one-third of its length dividing into two long branches forming an arch and reaching the bursal edge; at point of bifurcation, two small lateral rays are given off. Female characterised by long thin backwardly directed tail; parallel uteri; short ovejectors; long, thin vagina; and large thick-shelled eggs. Parasites in stomach of marsupials—Type species *B. buccalis*, from *Macropus dorsalis*. Other species *B. australis* n. sp., from *M. wilcoxi*.

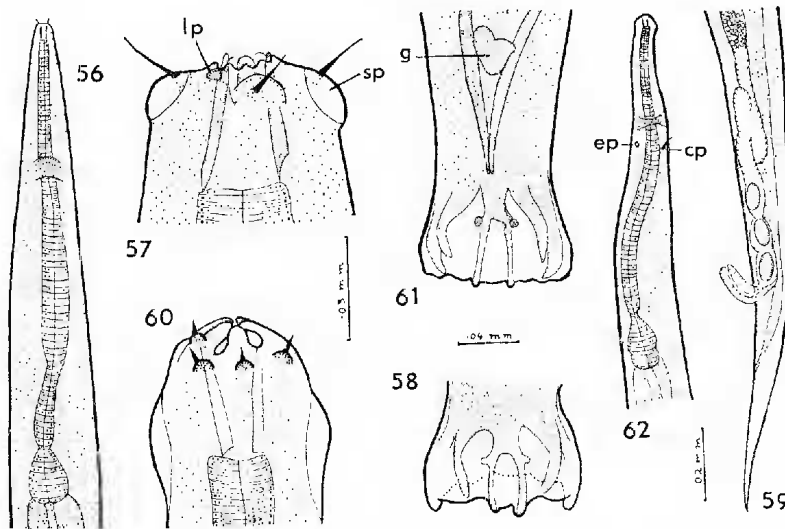
This new genus is near *Pharyngostrongylus* but differs from it in the absence of a striated vestibule and in the presence of a very long buccal capsule, the latter suggesting that of *Cylindropharynx*.

***Buccostrongylus buccalis* n. sp.**

Figs. 56-59

From stomach of *Macropus dorsalis* (type host), *M. wilcoxi* and *M. parryi* all from the Upper Burnett district (coll. Dr. Bancroft).

Small worms; male 3.72-5.3 mm. long; female 4.5 mm. At anterior end four large cuticular papillae in submedian positions, each with long hair-like appendage, 0.026 mm. long; two smaller lateral papillae. Around oral aperture



Figs. 56-59, *Buccostrongylus buccalis*: 56, Anterior end; 57, Head; 58, Dorsal view of bursa; 59, Posterior end of female. Figs. 60-62, *Buccostrongylus australis*: 60, Head; 61, Posterior end of male, dorsal view; 62, Anterior end. Figs. 56, 59, and 62 to same scale; figs. 57 and 60; figs. 58 and 61.

about eight small lobes. Buccal capsule cylindrical, long, (0.02-0.033 mm.), thin walled, without striations; posterior edge of wall thin, pointed; anterior border apparently prolonged into four structures resembling elements of a leaf crown. Oesophagus thin, long, 1.36-1.4 mm. (1:2.7-3.7 of body length in male); in female anterior cylindrical part 0.9 mm. long, widened posteriorly, surrounded near mid-length by nerve ring, and followed by narrower region (0.2 mm. long) constricted at its lower end to be succeeded by bulb about 0.15 mm. long. Intestine wide and thick-walled in anterior region. Nerve ring at 0.3 mm. from head end. Excretory pore and cervical papillae not observed.

*Male*—Spicules 1.56-1.67 mm. long, 1:2.4-3.1 of body length, rather stout, especially at tips which do not taper but end in a conical point; alae striated, wide, ending just before tip. Bursa small, lateral lobes the most prominent. Ventral rays parallel, reaching almost to bursal edge; externo-lateral rather shorter than laterals; laterals cleft for half their length, reaching nearly to edge of bursa. Externo-dorsal arising independently, reaching nearly to edge. Dorsal ray bifurcating after one quarter of length, each branch soon giving off a very short lateral ray and then passing backwards into a small projection of the dorsal lobe. Genital cone very short.

*Female*—Tail long, narrow, pointed, bending backwards from the vulva; vagina extended through the vulva to a greater or lesser extent in all females examined. Vulva at 0.7, and anus at 0.5 mm. from tip of tail; eggs (in vagina) 0.07 mm. by .05 mm.

***Buccostrongylus australis* n. sp.**

Figs. 60-62

From stomach of *Macropus wilcoxi* (type host) and *M. thetididis*, Eidsvold (coll. Dr. Bancroft).

Very small; male 4.5-4.7 mm. long; female 5.5-6.8 mm.; thin, body tapering towards head, latter surrounded by ring of inflated cuticle; body dark owing to pigment in intestine. Anterior end not clear in any of the numerous specimens examined; buccal capsule long (0.22-0.25 mm. long, 16  $\mu$  wide at top, 13  $\mu$  at base) with rather thick walls, anterior margin apparently simple, mouth with six lips more prominent than those of *B. buccalis*; papillae all of same size, each with stout bristle. Oesophagus long, 0.82-1 mm. in male (1:4.7-5.4 of body length), 1-1.17 mm. in female (1:5-5.8 of body length), slightly constricted near posterior end before widening into bulb, latter generally with slight constriction in its mid-region. Nerve ring at 0.27-0.29 mm., excretory pore at 0.36 mm. behind head end. Cervical papillae very long, hair-like, situated at 0.37-0.4 mm. from anterior end.

*Male*—Bursa very small; ventral lobes very small, separate. Ventral rays parallel, cleft for about half length; externo-laterals and laterals arising together, short, stout; laterals longest, cleft for most of length. Externo-dorsal long, stout, arising separately, curving towards dorsal ray, not reaching bursal edge. Dorsal ray subdividing at about one-third length; the two branches well separated, more or less parallel, long; each branch giving off very short lateral soon after origin from main stem. Spicules long, 1.2-1.37 mm., 1:3.4-3.7 of body length, slender, with wide striated alae and tapering joined tips. Gubernaculum heart-shaped in dorso-ventral view, but wider anteriorly and pointed posteriorly when seen in lateral view. Genital cone insignificant.

*Female*—Posterior end drawn out into long tapering, but not sharply pointed, tail. Ovejectors short; vagina long; vulva 0.8-0.9 mm., and anus 0.45-0.55 mm. from posterior end. Eggs 0.09 by .04 mm.

This species is distinguished from *B. buccalis* by its shorter buccal capsule; longer lips; shorter stouter bristles on the papillae; relatively shorter, differently

shaped, oesophagus; shorter spicules; longer tail region of the female; and in having the anterior end of buccal capsule apparently without small projections.

MACROPOSTRONGYLUS Yorke and Maplestone, 1926

MACROPOSTRONGYLUS YORKEI Baylis, 1927

We have recognised this species from *Macropus agilis* (Gregory River, North Queensland, coll. Dr. Roberts), *M. parryi* (Upper Burnett region, coll. Dr. Bancroft), and *M. zvelsbyi* (Stradbroke Island, South Queensland). Baylis found it in material from *Macropus* sp. (1927) from Townsville and from *Macropus agilis* from Burketown (1934).

MACROPOSTRONGYLUS MACROPOSTRONGYLUS Y. and M., 1926

We record the occurrence of the type species of the genus in *M. agilis* from Gregory River, North Queensland (coll. Dr. Roberts), and *Macropus zvelsbyi* from Stradbroke Island.

**Papillostrongylus** new genus

*Trichoneminae*—Mouth directed straight forwards. Mouth collar with eight papillae; four submedian bearing bristles; dorsal and ventral papillae small, rather chitinised and projecting (in lateral view) like a blunt hook; two laterals appearing tridentate in ventral view. Buccal capsule large, bilaterally symmetrical; the dorsal and ventral walls sloping down and inwards in a straight line, lateral walls being concave inwardly and convex outwardly. Oesophagus relatively long, terminating in a slight bulb.

*Male*—Bursa small; ventral lobes short, separate; dorsal lobe large. Ventral rays parallel and together; externo-lateral, lateral and externo-dorsal rays arising together; laterals parallel and long; dorsal bifurcating, each stem with a short lateral branch. Spicules thin, long, simple.

*Female*—Uteri parallel; vagina fairly long; vulva a short distance in front of anus; tail tapering, pointed.

Type *P. labiatus* n. sp. from stomach of *Macropus dorsalis*. The genus is close to *Macropostrongylus* but is differentiated from it by the shape of the buccal capsule, the absence of a leaf crown and the presence of eight distinctive papillae around the mouth. This genus is distinguished from *Cloacina* by the shape of the vestibule; the number and shape of the head papillae; and the absence of a corona radiata.

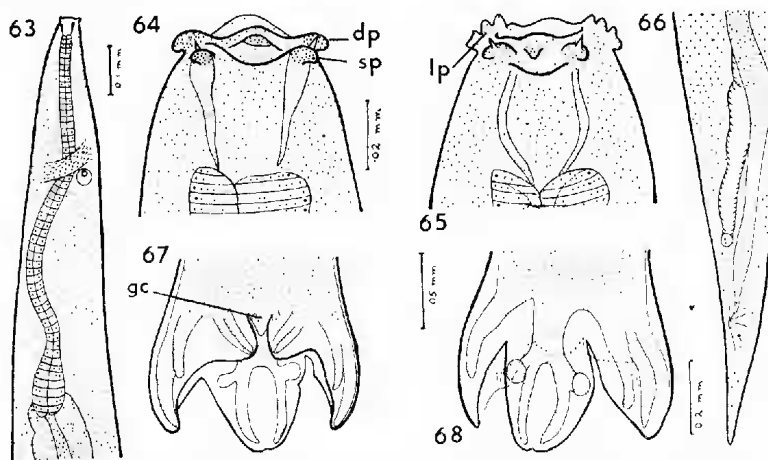
**Papillostrongylus labiatus** n. sp.

Figs. 63-68

From the stomach of *Macropus dorsalis* Eidsvold (Dr. M. J. Mackerras). Only a male and a female specimen, both juvenile, were found.

Short, thin; male 4.7 mm. long; female 7 mm.; maximum breadth of male 0.28 mm. Eight head papillae; the four submedian each projecting outwards and bearing short anteriorly-directed bristle; dorsal and ventral papillae more chitinised

than the others and in lateral view projecting outwards and downwards like a thick blunt hook; lateral papillae large, simple, tridentate (fig. 65). Buccal capsule 0.036 mm. long, chitinised; walls in lateral view nearly straight, thickest anteriorly, closer together posteriorly, but in ventral view appearing to have uniform thickness and each side with concavity inwardly. No leaf crown. Oesophagus very long, 0.65 mm. in male (1:7 of body length), 0.83 in female (1:8 of body length), with very slight posterior bulb. Nerve ring at 0.3 mm. from head end of female and just behind level of first third of oesophagus; excretory pore at 0.33 mm., just behind nerve ring; cervical papillae at 0.09 mm. from anterior end (female).



Figs. 63-68, *Papillostrongylus labiatus*: 63, Anterior end; 64, Lateral view of head; 65, Dorsal view of head; 66, Posterior end of female; 67, Ventral view of bursa; 68, Dorsal view of bursa. Figs. 64 and 65 to same scale; figs. 67 and 68.

*Male*—Bursa small; ventral lobes small, separate; laterals long; dorsal lobe longer. Ventral rays parallel, cleft for nearly all length, reaching bursal edge; externo-laterals short; laterals long; externo-dorsal arising from same root and as long as externo-lateral. Dorsal ray stout, bifurcating at mid-length, each branch almost reaching edge, and giving off short lateral just beyond region of bifurcation. Genital cone short; accessory cone with two bilobed projections. Spicules relatively very long, 2 mm. (1:2.35 of body length), thin, curved within body, ending in separate points.

*Female*—Body tapering beyond vaginal region to end in bluntly pointed tail; uteri parallel; vagina about 0.4 mm. long; vulva at 0.38, and anus at 0.34 mm. from posterior end.

#### **Coronostrongylus** n. gen.

*Trichoneminac*.—Short worms; buccal cavity lined by thick continuation of cuticle, and reinforced around its lower part by stout buccal ring. Leaf crown of 20-25 elements; six papillae around mouth. Oesophagus with longer anterior



portion and shorter posterior part ending in bulb. Characters of male insufficiently known. From marsupials. Type, *C. coronatus* n. sp. It differs from other genera in the character of the buccal capsule and in the presence of numerous clements in the leaf crown.

**Coronostrongylus coronatus** n. sp.

Fig. 69

Only two specimens of this species have been found, a male in the stomach of *Macropus wilcoxi* (type host) and a female in the stomach of *M. thetidis*, both from Eidsvold (Dr. Bancroft). Both worms were greatly wrinkled, as if the

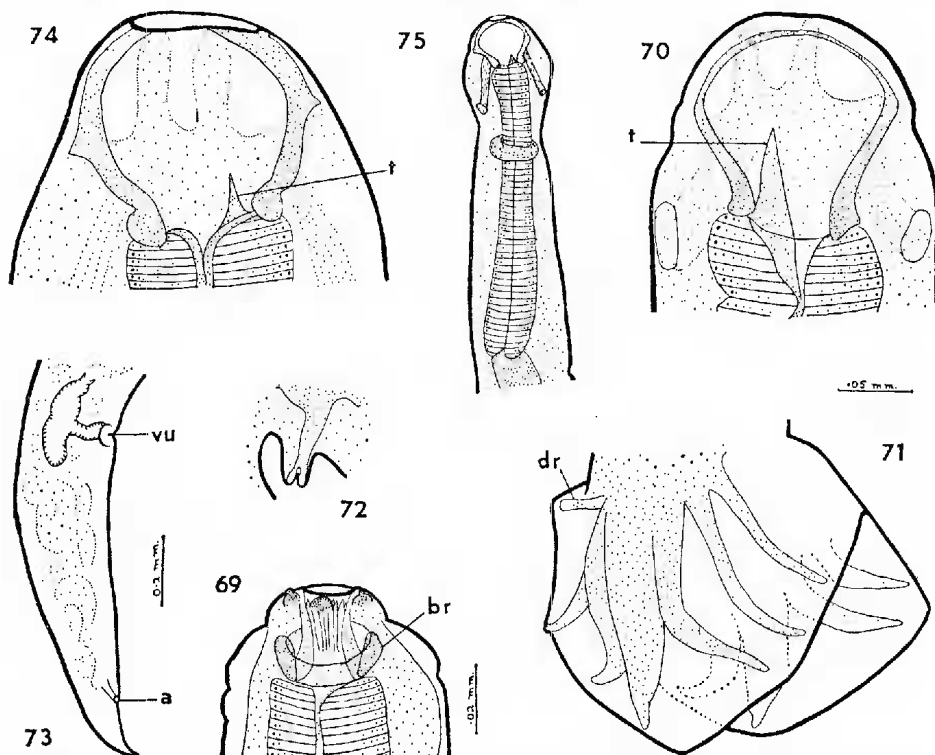


Fig. 69. *Coronostrongylus coronatus*: Lateral view of head. Figs. 70-73, *Globoccephaloides wallabiae*: 70, Lateral view of head; 71, Lateral view of bursa; 72, Dorsal ray; 73, Posterior end of female. Figs. 74-75, *Globoccephaloides affinis*: 74, Lateral view of head; 75, Anterior end, lateral view. Figs. 70, 71, 72 and 74 to same scale; figs. 73 and 75.

cuticle had been thrown into many circular folds by the contraction of the tissues beneath it. They appear (in this condition) as short stout nematodes, the male 2.85 mm. long, and the female 3.6 mm. long. A very stout chitinous ring, 0.014 mm. deep and .022 mm. in internal diameter surrounding base of buccal cavity, and from the base of this the inner lining of the buccal cavity rises up to become continuous with the cuticle around mouth. Leaf crown of numerous

(20-25) long thin elements rising from posterior circumference of buccal cavity but apparently distinct from, although parallel to, the chitin lining the cavity. Mouth circular, simple; surrounded by six rounded papillae, each with small rounded projection distally. Oesophagus bent, in the two specimens examined, but not the same way in each case, lending support to the view that the worms have shrunk; in male 0.47 mm. long, in female .48 mm.; 1:6-7 of body length, respectively; widening gradually for the first two-thirds of length, then suddenly narrowing and then widening to end in large bulb. In the female the long, hair-like cervical papillae are 0.15 mm., and the nerve ring 0.21 mm. from the anterior end.

*Male*—The bursa covered on inside with papillae. Arrangement of rays not traced satisfactorily, but dorsal ray appears to end in two long branches. Roundish gubernaculum present. Spicules 1.1 mm. long, 1:2.6 of body length. Specimen, unfortunately, lost before completion of its examination.

*Female*—The condition of the specimen prevented its adequate study. Body narrowing suddenly to form long thin tail, greatly wrinkled, probably because of shrinkage.

#### Genus GLOBOCEPHALOIDES Y. and M., 1926

The discovery of two new species of this genus, one of them represented by males and females, has made it possible to amplify Yorke and Maplestone's generic diagnosis, and to indicate its systematic relationships. The characters of the copulatory bursa, the presence of a well-defined sub-globular buccal capsule, the absence of a leaf crown or mouth collar, and the absence of cutting organs guarding the oral aperture, indicate a close relationship with *Globocephalus*, as was suggested by Yorke and Maplestone. It differs from this genus chiefly in the structure of the bursa; each of the ventral and lateral rays being separate from one another, the dorsal ray relatively shorter and its two branches not tridigitate. The position of the vagina is quite different in the two genera.

An amended definition of the genus is now offered: *Strongylinae*—Small worms, anterior extremity inclined dorsally, mouth opening circular, without corona radiata. Buccal capsule large, subglobular; duct of dorsal oesophageal gland not projecting into mouth cavity; a prominent triangular subventral tooth in base of capsule. Oesophagus slightly club-shaped posteriorly.

*Male*—Bursa prominent with two large lateral lobes and a much smaller dorsal lobe. All rays separate, nearly reaching edge of bursa; ventrals thinnest, medio-lateral stoutest and tapering suddenly; externo-dorsal arising at base of dorsal; dorsal ray bifid at tip. Spicules equal, alate, tapering to a fine point.

*Female*—Posterior end tapering regularly, ending in conical tail; vulva in posterior quarter of length; vagina short; uteri divergent; oviparous.

Parasites of alimentary tract of marsupials. Type species: *G. macropodis* Y. and M., 1926 (male unknown), from *Macropus* sp.

Freitas and Lent (1906) described *Globocephalus marsupialis* from a Brazilian polyprotodont, *Metachirus opossum* L., and placed *Globocephaloides* as a synonym of *Globocephalus*, an emended diagnosis of the latter being published. As already stated by us, we regard the two genera as quite distinct. The Brazilian species does not belong to the Australian genus.

***Globocephaloides wallabiae* n. sp.**

Figs. 70-73

From intestine of *Macropus dorsalis*, Eidsvold (Dr. Bancroft).

Very small worms; male 4.2 mm. long; female 4.4 mm. Anterior end rounded. Buccal capsule large, subglobular, 0.05 mm. wide, 0.055 mm. long, strongly chitinised, lower part of walls thicker than roofing portions, base with out-turned rim. Arising from subcuticular region just behind level of floor of buccal cavity are four strongly chitinised supports lying against walls of capsule for about half the length of the latter, these supports probably submedian in position. "Pulp" extending to front of head region as six (perhaps eight) long masses, but not piercing the cuticle to produce definite papillae; papillae not detected. Cuticular lining of buccal cavity continued into oesophagus and forming pointed subventral tooth projecting 0.025 mm. into buccal cavity. Oesophagus 0.52-0.55 mm. long (1:8 of body length); widening gradually posteriorly.

*Male*—Bursa large, consisting chiefly of two large lobes lying laterally and not subdivided into lateral and ventral lobes; dorsal lobe very short, narrow. Ventral rays long, thin, separate, curving ventrally; externo-lateral thin, long, curving laterally; two laterals separate, stout, with distal ends compressed; externo-dorsal thin, projecting on edge of bursa. Dorsal ray very short, narrow, bifurcate distally, its two branches extending each into a short lappet of the dorsal ray. Spicules short, 0.4 mm. long, 1:10 of body length, rather wide, distal two-thirds with curved outer edges; tips spoon-like.

*Female*—Body tapering beyond anus; sharp pointed tail curved ventrally; vulva at 0.95 mm. from tail end (*i.e.*, 1:4.6 of body length); uteri divergent; ovejectors short; anus at 0.2 mm. from end of body; eggs 0.095 by 0.055 mm.

The species differs from *G. macropodis* in its length, the size of the buccal capsule, length of oesophagus, position of vulva, and size of dorsal tooth. Yorke and Maplestone gave 400  $\mu$  as the depth of the buccal capsule and 900  $\mu$  as the length of the oesophagus, the former being apparently an error for 40  $\mu$ .

***Globocephaloides affinis* n. sp.**

Figs. 74-75

Three females were found amongst material from the intestine of *Macropus dorsalis* from Eidsvold (Dr. Bancroft). The species resembled closely *G. wallabiae* in general features. Length, 6.7 mm. Cuticle of head markedly inflated. Chitinous supports to buccal capsule arising more posteriorly than in the former

species. Capsule 0.13 mm. deep, 0.12 mm. wide. Oesophagus 0.85 mm. long. 1:8 of body length. Nerve cord probably at 0.25 mm. from head end. Vagina at 0.19 from tip of tail, *i.e.*, about 1:3.5 of body length. Eggs 0.1 by .045 mm.

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